WHAT IS CLAIMED IS:

1. A polymer electrolyte for a lithium sulfur battery comprising:

a monomer including a methacrylate group;

an initiator; and

an electrolytic solution comprising an organic solvent and a lithium salt.

2. The polymer electrolyte of claim 1, wherein the monomer has at least one carbon-carbon double bond at a terminal end.

3. The polymer electrolyte of claim 2, wherein the monomer is selected from the group consisting of multifunctional acrylates, poly(ethyleneglycol) dimethacrylate, poly(ethyleneglycol) diacrylate, poly(ethyleneglycol) divinylether ethylene glycol dimethacrylate, ethylene glycol diacrylate, ethyleneglycol divinylether, hexanediol diacrylate, tripropyleneglycol diacrylate, tetraethyleneglycol monoacrylate, caprolactone acrylate and mixtures thereof, wherein the multifunctional acrylate is poly(ester)(metha)acrylate in which hydroxide groups in (polyester)polyol are partially or totally substituted with (metha)acrylic ester and un-substituted hydroxide groups are substituted with a group having no radical reactivity.

4. The polymer electrolyte of claim 3, wherein the monomer is polyethyleneglycoldimethacrylate or poly(ester)(metha)acrylate in which hydroxide groups in (polyester)polyol are partially or totally substituted with (metha)acrylic ester and un-substituted hydroxide groups are substituted with a group having no radical reactivity.

5. The polymer electrolyte of claim 3, wherein the group having no radical reactivity is selected from the group consisting of C_1 to C_{20} aliphatic hydrocarbon groups, C_5 to C_{20} aromatic hydrocarbon groups, C_1 to C_{20} ether groups, and C_1 to C_{20} ester groups.

6. The polymer electrolyte of claim 3, wherein the mixing mole ratio of the methacrylic ester and the group having no radical reactivity is 1 : 0.01 to 1 : 100.

7. The polymer electrolyte of claim 3, wherein the monomer is poly(ester)(metha)acrylate in which hydroxide groups in (polyester)polyol are partially or totally substituted with (metha)acrylic ester and un-substituted hydroxide groups are substituted with a group having no radical reactivity.

8. The polymer electrolyte of claim 1, wherein the mixing weight ratio of the electrolytic solution to the monomer ranges from greater than 10:1 to 200:1.

9. The polymer electrolyte of claim 8, wherein the mixing weight ratio of the electrolytic solution to the monomer is 40 to 150 : 1.

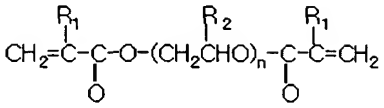
10. The polymer electrolyte of claim 9, wherein the mixing weight ratio of the electrolytic solution to the monomer is 60 to 120 : 1.

11. The polymer electrolyte of claim 3, wherein the group having no radical reactivity is selected from the group consisting of $-OC(=O)(CH_2)_3CH_3$, $-OC(=O)Ar$ where Ar is an unsubstituted or substituted aromatic hydrocarbon group, $-OC(=O)(CH_2)_nO(CH_2)_nCH_3$ where n is an integer from 1 to 20, $-O(C=O)(CH_2)_nOC(=O)(CH_2)_nCH_3$ where n is an integer from 1 to 20, and $-O(C=O)CH=CH_2$.

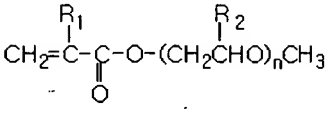
12. The polymer electrolyte of claim 1, wherein the monomer is a (metha)acrylic ester selected from $-OC(=O)(CH_2)_nOC(=O)CH=CH_2$ and $-OC(=O)(CH_2)_nOC(=O)C(CH_3)=CH_2$, wherein n is an integer of 1 to 20.

13. The polymer electrolyte of claim 1, wherein the monomer is selected from compounds represented by the formulas 1 and 2:

Formula 1



Formula 2



where R_1 is H or a C_1 to C_6 alkyl group; n is an integer from 1 to 100,000; and R_2 is H or a C_1 to C_6 alkyl group.

14. The polymer electrolyte of claim 1, wherein the initiator is at least one selected from the group consisting of isobutyl peroxide, lauroyl peroxide, benzoyl peroxide, m-tolluoyl peroxide, t-butyl peroxy-2-ethyl hexanoate, t-butyl peroxy bibarate, t-butyloxyneodecanate, diisopropyl peroxy dicarbonate, diethoxy peroxy dicarbonate, bis-(4-t-butylcyclohexyl)peroxy dicarbonate, dimethoxy isopropyl peroxy dicarbonate, dicyclo hexylperoxy dicarbonate, 3,3,5-trimethylhexanoyl peroxide, succinic peroxide didecarbonylperoxide, dicumyl peroxide, di-t-butyl peroxide, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane, alpha-cumyl peroxy neodecanate, 1,1-dimethyl-3-hydroxybutyl peroxy-2-ethyl hexanoate, 2,5-dihydroperoxy-2,5-dimethylhexane, cumene hydroperoxide, t-butyl hydroperoxide, 2,2-di(t-butylperoxy)butane, ethyl 3,3-di(t-butylperoxy)-butylate, di(n-propyl)peroxy-dicarbonate, di(sec-butyl)perxy dicarbonate, di(2-ethylhexyl)peroxy dicarbonate, and azobis isobutyronitrile.

15. The polymer electrolyte of claim 1, wherein the initiator is present in an amount of 0.3 to 5 parts by weight based on 100 parts by weight of the polymer.

16. The polymer electrolyte of claim 1, wherein the polyester polyol is at least one selected from the group consisting of trialkylols, glycerols, and erythritols.

17. A lithium sulfur battery comprising:

a positive electrode comprising at least one positive active material selected from the group consisting of elemental sulfur, sulfur-based compounds, and mixtures thereof;

a negative electrode comprising a negative active material selected from the group consisting of materials that are capable of reversibly intercalating or deintercalating lithium ions, materials that react with lithium ions to prepare a lithium-included compound, lithium metals, and lithium alloys; and

a polymer electrolyte comprising a monomer including a methacrylate group, an initiator, and an electrolytic solution comprising an organic solvent and a lithium salt.

18. The polymer electrolyte of claim 17, wherein the monomer has at least one carbon-carbon double bond at a terminal end.

19. The lithium sulfur battery of claim 18, wherein the monomer is selected from the group consisting of multifunctional acrylates, poly(ethyleneglycol) dimethacrylate, poly(ethyleneglycol) diacrylate, poly(ethyleneglycol) divinylether ethylene glycol dimethacrylate, ethylene glycol diacrylate, ethyleneglycol divinylether, hexanediol diacrylate, tripropyleneglycol diacrylate, tetraethyleneglycol monoacrylate, caprolactone acrylate and mixtures thereof, wherein the multifunctional acrylate is poly(ester)(metha)acrylate in which hydroxide groups in (polyester)polyol are partially or totally substituted with (metha)acrylic ester and un-substituted hydroxide groups are substituted with a group having no radical reactivity.

20. The lithium sulfur battery of claim 19, wherein the monomer is polyethyleneglycoldimethacrylate or poly(ester)(metha)acrylate in which hydroxide groups in (polyester)polyol are partially or totally substituted with (metha)acrylic ester, and un-substituted hydroxide groups are substituted with a group having no radical reactivity.

21. The lithium sulfur battery of claim 20, wherein the monomer is poly(ester)(metha)acrylate in which hydroxide groups in (polyester)polyol are

partially or totally substituted with (metha)acrylic ester, and un-substituted hydroxide groups are substituted with a group having no radical reactivity.

22. The lithium sulfur battery of claim 19, wherein the group having no radical reactivity is selected from the group consisting of C_1 to C_{20} aliphatic hydrocarbon groups, C_5 to C_{20} aromatic hydrocarbon groups, C_1 to C_{20} ether groups and C_1 to C_{20} ester groups.

23. The lithium sulfur battery of claim 19, wherein the group having no radical reactivity is selected from the group consisting of $-OC(=O)(CH_2)_3CH_3$, $-OC(=O)Ar$ where Ar is an unsubstituted or substituted aromatic hydrocarbon group, $-OC(=O)(CH_2)_nO(CH_2)_nCH_3$ where n is an integer of 1 to 20, $-O(C=O)(CH_2)_nOC(=O)(CH_2)_nCH_3$ where n is an integer of 1 to 20, and $-O(C=O)CH=CH_2$.

24. The lithium sulfur battery of claim 17, wherein the mixing weight ratio of the electrolytic solution to the monomer ranges from greater than 10:1 to 200:1.

25. The lithium sulfur battery of claim 24, wherein the mixing weight ratio of the electrolytic solution to the monomer is 40 to 150 : 1.

26. The lithium sulfur battery of claim 25, wherein the mixing weight ratio of the electrolytic solution to the monomer is 60 to 120 : 1.

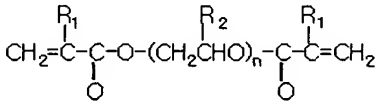
27. The lithium sulfur battery of claim 17, wherein the monomer is a (metha)acrylic ester selected from $-OC(=O)(CH_2)_nOC(=O)CH=CH_2$ and $-OC(=O)(CH_2)_nOC(=O)C(CH_3)=CH_2$, where n is an integer of 1 to 20.

28. The lithium sulfur battery of claim 17, wherein the monomer is selected from the group consisting of polymers of polyester (metha)acrylate in which hydroxide groups in polyester polyol are partially or totally substituted with (metha)acrylic ester, poly(ethyleneglycol)dimethaerylate, poly(ethyleneglycol) diacrylate, poly(ethyleneglycol) divinylether ethylene glycol dimethacrylate, ethylene glycol diacrylate, ethyleneglycol divinylether, hexanediol diacrylate,

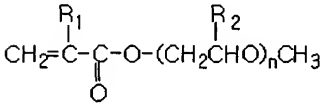
tripropyleneglycol diacrylate, tetraethyleneglycol monoacrylate, caprolactone acrylate, and mixtures thereof.

29. The lithium sulfur battery of claim 17, wherein the monomer is selected from compounds represented by the formulas 1 and 2:

Formula 1



Formula 2



where R_1 is H or a C_1 to C_6 alkyl group; n is an integer of 1 to 100,000; and R_2 is H or a C_1 to C_6 alkyl group.

30. The lithium sulfur battery of claim 19, wherein the mixing mole ratio of the methacrylic ester and the group having no radical reactivity is 1 : 0.01 to 1 : 100.

31. The lithium sulfur battery of claim 17, wherein the initiator is at least one selected from the group consisting of isobutyl peroxide, lauroyl peroxide, benzoyl peroxide, m-tolluoyl peroxide, t-butyl peroxy-2-ethyl hexanoate, t-butyl peroxy bibarate, t-butyloxyneodecanate, diisopropyl peroxy dicarbonate, diethoxy peroxy dicarbonate, bis-(4-t-butylcyclohexyl)peroxy dicarbonate, dimethoxy isopropyl peroxy dicarbonate, dicyclo hexylperoxy dicarbonate, 3,3,5-trimethylhexanoyl peroxide, succinic peroxide didecarbonylperoxide, dicumyl peroxide, di-t-butyl peroxide, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane, alpha-cumyl peroxy neodecanate, 1,1-dimethyl-3-hydroxybutyl peroxy-2-ethyl hexanoate, 2,5-dihydroperoxy-2,5-dimethylhexane, cumene hydroperoxide, t-butyl hydroperoxide, 2,2-di(t-butylperoxy)butane, ethyl 3,3-di(t-butylperoxy)-butylate, di(n-propyl)peroxy-dicarbonate, di(sec-butyl)perxy dicarbonate, di(2-ethylhexyl)peroxy dicarbonate, and azobis isobutyronitrile.

32. The lithium sulfur battery of claim 17, wherein the initiator is present in an amount of 0.3 to 5 parts by weight based on 100 parts by weight of the polymer.

33. The lithium sulfur battery of claim 17, wherein the polyester polyol is at least one selected from the group consisting of trialkylols, glycerols, and erythritols.

34. The lithium sulfur battery of claim 17, wherein the positive active material is selected from the group consisting of elemental sulfur, organic sulfur compounds selected from the group consisting of Li_2S_n, where $n \geq 1$, and Li_2S_n, where $n \geq 1$, dissolved in catholyte, and a carbon-sulfur polymer of the formula $(C_2S_x)_n$, where $x=2.5$ to 50 and $n \geq 2$.